

Brief Radiation Primer

How does ionizing radiation (IR) affect cells, tissues and organs? The term ionizing is the clue. Ionizing radiation can be present in two forms - waves and particles. Depending on the form IR can travel various distances through matter. As IR passes through human tissue it can cause damage to intracellular elements. Such damage can result in cell death, cell dysfunction or cellular repair. If enough cells die, a tissue or organ can lose its activity. Abnormal differentiation can lead to cancer or faulty metabolism and production of harmful bioactive substances (e.g., hormonally active proteins). While all IR can cause such damage, each type (e.g., gamma rays, beta particles) has different probabilities of doing so.

Gamma rays are the same as x-rays - electromagnetic waves of energy that travel at the speed of light. They are best blocked by thick shielding or dense material. Gamma rays can damage tissue from external or internal exposures.

Beta particles are physically identical to electrons. They typically travel short distances and can be blocked by non-metallic, low density material such as plastic.

Half-life is the length of time during which any radioactive substance will lose one-half of its radioactivity.

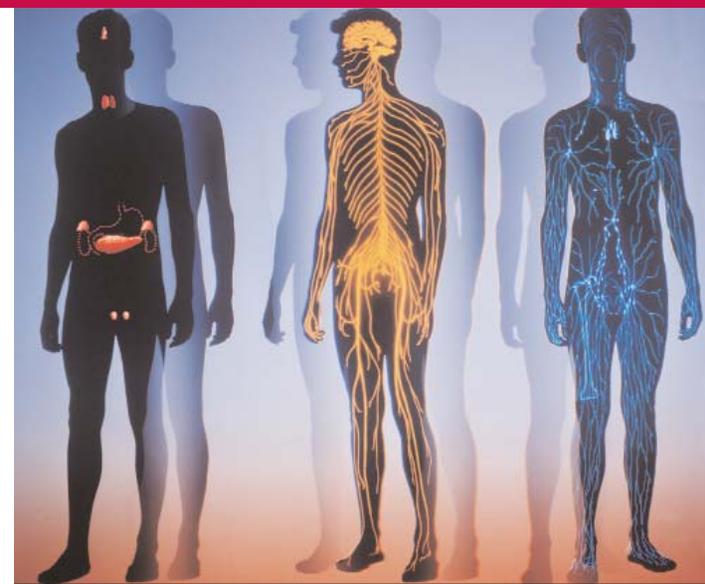
NOTES

- ¹ IAEA Health Watch, No. 4, 2000-2001
<http://www.iaea.or.at/worldatom/Press/Focus/Chernobyl-15/unscear.pdf>
- ² Exposure of the American People to Iodine-131 from Nevada Nuclear-Bomb Tests: Review of the National Cancer Institute Report and Public Health Implications (1999), National Academy Press
<http://www.nap.edu/books/030906175X/html/>
- ³ NCI, "About Radiation Fallout"
http://rex.nci.nih.gov/INTRFCE_GIFS/radiation_fallout/radiation_131.html
- ⁴ CANCER FACTS National Cancer Institute National Institutes of Health <http://www.meb.uni-bonn.de/Cancernet/600631.html>
- ⁵ Guide to Clinical Preventive Services, Second Edition Neoplastic Diseases, Screening for Thyroid Cancer
<http://cpmcnet.columbia.edu/texts/gcps/gcps0028.html>

CONTACT US

This fact sheet was developed by the Hanford Community Health Project (HCHP), which is sponsored by the Agency for Toxic Substances and Disease Registry (ATSDR).

Individuals with any questions about the project should contact the HCHP at 1-800-207-3996 or by e-mail message at Hanford@norem.uchicago.edu. You can also contact ATSDR directly at 1-888-42ATSDR or 1-888-422-8737. The project web site is also available at www.hanfordhealth.info.



**Request for
Medical
Evaluation
for
Past Exposure
to I-131**

Why I Am Here to See You?

When I was a child, I lived in an area contaminated by radioactive materials released during nuclear weapons production and/or testing. Radioactive iodine (radioiodine or I-131), released into the air, contaminated the food—mostly milk—that I consumed. I-131 is the substance that medical scientists consider the most likely to cause health effects.¹ I am now concerned that I might suffer from one of those effects.

What Happened?

In the early years (1944-1951) during production of weapons-grade plutonium and uranium at the Hanford Nuclear site, large amounts of radioactive by-products were released into the surrounding air, water, and ground (see map). It wasn't until 1986 that information about these releases was made public. Also, in 1997, the government informed the public that tens of thousands of people were exposed to I-131 from nuclear weapons testing at the Nevada Test site.² Scientists have done epidemiologic studies and developed computer models that give some idea of the dosages of I-131 that people might have received.³ They have determined that many people received potentially harmful doses, especially when all sources of I-131 are considered.

What Are the Health Effects of I-131?

The thyroid gland selectively takes up I-131 from the bloodstream just as it does non-radioactive iodine. Beta particles and gamma rays (two forms of ionizing radiation) produced by the radioactive decay of I-131 atoms (half-life, 8 days) bombard the sensitive cells of the thyroid. The younger the individual, the more sensitive is the thyroid to the effects of this exposure. Ionizing radiation injures cells and can result in death of the cell, repair of the cell, or abnormal cell division and differentiation. It is well known that ionizing radiation can cause cancer of the thyroid gland.⁴ Such cancers typically do not develop until years—sometimes decades—after the exposure. Other radiation effects include benign thyroid nodules, autoimmune thyroiditis, hypothyroidism, and hyperparathyroidism.

What Can You Do For Me?

Because the most likely health effects of I-131 involve the thyroid gland, I would like you to check mine. Mostly, I am here for reassurance, so I would like you to test and examine me for thyroid (and parathyroid) disease. Simple blood tests (TSH, serum calcium, phosphate) can rule out most of the illnesses about which I am concerned. Your examination—palpation—of my thyroid gland will address my concerns that

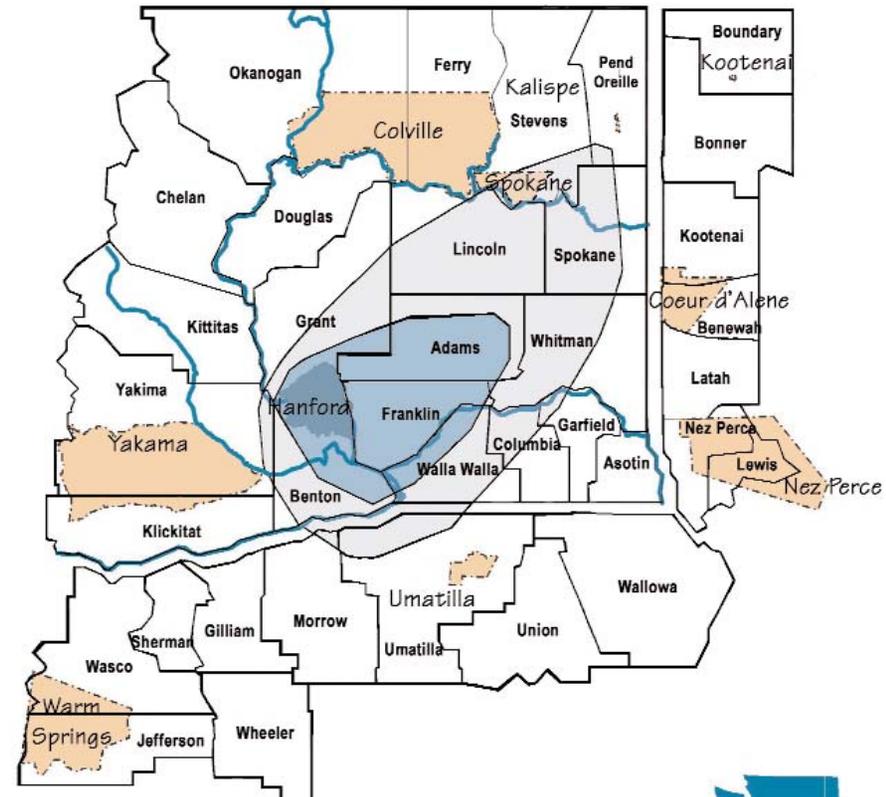
a malignancy could be there. If you have any doubt about what you feel in my thyroid, you could order an ultrasound examination, but that isn't recommended by medical authorities for routine screening.⁵ To make this more convenient, the ICD codes for all these procedures and possible diagnoses are listed below.

193	Malignant Neoplasm of Thyroid Gland
226	Benign Neoplasm of Thyroid Glands
246.9	Disorders of Thyroid Gland
244.9	Acquired Hypothyroidism
245.9	Thyroiditis
252	Hyperparathyroidism
84443	Serum TSH
82310	Serum calcium
84100	Serum phosphate
76536	Thyroid Ultrasound

What Else Should We Discuss?

Of course, there are many studies that show radiation exposure can cause many different kinds of cancer. If cancer runs in my family, this may add to my risk as well. So please discuss my cancer risks in light of these risk factors. If there are other cancer screening tests I should have, let's talk about those.

Extent of 10-Rad Thyroid Dose to Children 0-4 and 5-19 Years 1945 Exposure Year



- 10-Rad Dose, 0- to 4- Year Old Children
- 10-Rad Dose, 5- to 19- Year Old Children
- Native American Reservation

Source: HEDR Median Thyroid Dose Estimates, Centers for Disease Control and Prevention

Note: Health risk from other substances and pathways are under review.

